SUPPORTING INDUSTRIES

Project Fact Sheet

Materials and Process Design for High Temperature Carburizing

Benefits

- Accelerated replacement of the conventional steels with a new class of carburizing steels with greatly broadened applications
- Expected lifetime of furnace using new technology is in order of 20 years
- Estimated reduction in the U.S. annual energy consumption for carburizing from 80 trillion Btus to 20-24 trillion Btus
- Reduction in greenhouse gases compared to conventional gas carburizing technology
- Reduced scrap and elimination of the need for hard chromium plating in many applications

Applications

The heat treating technology will produce ultra-hard tools, dies, and parts for the steel industry. It may also be applied to the aluminum industry with the production of ultra-durable die materials for forging and forming of steel and aluminum, and for die casting of aluminum.

A computational materials design approach to integrated process and materials optimization that will create a new class of thermally-stable, ultra-durable case-hardened die steels

This project will integrate an optimization of process and materials to enable a broad usage of high temperature carburization in order to reduce cycle times. Both vacuum and plasma methods will be covered to ensure the broadest availability of commercial heat treatment processes. The unique capabilities of high-temperature carburizing will be exploited to access new levels of steel performance including the distortion-free high-performance bearing and gear materials for the transportation sector. Emphasis will be placed on the creation of a new class of thermally-stable, utlra-durable, case-hardened tool and die steels enabling major productivity gains in the forging, forming and die casting of aluminum and steel.

System Diagram

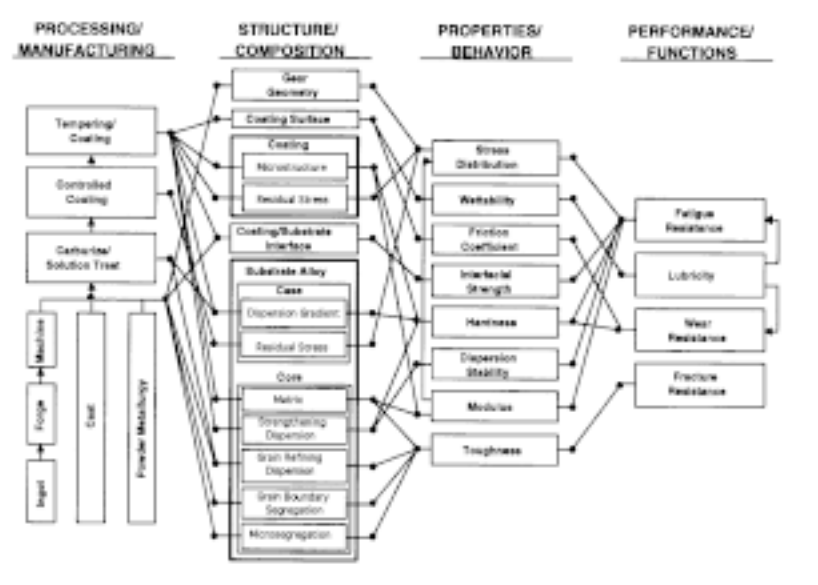

Illustration of the process and materials in high temperature carburization.

Project Description

Goal: The objectives of this research are to:

- Establish sufficient control of high temperature carburizing to greatly expand application.
- Create a new class of steels with particular emphasis on tooling and die applications.
- Demonstrate accelerated materials and process development through the emerging technology of computational materials design.

The process technology will increase energy efficiency, reduce waste, and increase productivity of the domestic supporting industries.

Progress and Milestones

- Project start date, September 2001.
- Project end date, August 2005.
- Conduct control experiments to optimize energy efficiency of high temperature carburizing process
- Model the high temperature carburizing process

Commercialization Plans

To be determined.

PROJECT PARTNERS

The Center for Heat Treating Excellence (CHTE) of the Worcester Polytechnic Institute (WPI)
Worcester, MA

Northwestern University Steel Research Group
Evanston, IL

Several CHTE Participating Companies

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